WRISTWATCH COMPRISING ONE-PIECE ELASTIC STRAP

The present invention relates to wristwatches with a one-piece elastic strap. More specifically, it relates to a wristwatch in which the strap is a spring strip that is curved in such a way as to wrap itself around the wrist.

An object of this kind is disclosed in document FR 2 792 502. Its strap is a strip of spring steel possessing two stable states, in one of which it is straight and in the other of which it is coiled into a spiral. This strap is enclosed in a flexible sheath or covering that is heat-welded around the strap and carries decorative or functional features such as a watch case.

It is an object of the present invention to provide an improved version of a watch using the same type of spring strap.

More precisely, the invention relates to a wristwatch having functional components and a one-piece spring strap made from an elastic metal strip possessing two stable states, in one of which it is straight, and which are produced by being put through two rollings, one along its length and the other across its width. This wristwatch is characterized in that its functional components are located on one of the ends of the strip and fixed to a flexible printed circuit attached to the strip.

In a preferred embodiment, the wristwatch according to the invention is an electronic wristwatch that also has the following main features:

- its functional components are fixed to a flexible printed circuit attached to the strip and having conducting tracks connecting them to each other;

- the printed circuit is attached to the strip by a spot of adhesive positioned at its center on the longitudinal axis of the strip;
- the rigid components, namely the quartz oscillator, the integrated circuit and the power source, are positioned on the edges of the strip;
- the printed circuit is cut to fit around the rigid components, except where the conducting tracks connect these to the other components;
- the wristwatch control means is positioned over the spot of adhesive, in the longitudinal axis of the strip;
- the power source is a rechargeable battery connected to a thermoelectric generator fixed to the strip by means of a heat-conducting adhesive;
- the watch possesses a liquid-crystal display consisting of two flexible bands, one for displaying the hour and the other the minutes, and respectively comprising twelve boxes aligned in a column bearing the series of numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 and twelve boxes aligned in a column bearing the series of numbers 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55;
- the wristwatch is enclosed in a flexible plastic sheath.

Other features of the invention will be found more explicitly in the following description, which refers to the accompanying drawing in which:

- figure 1 shows the wristwatch, seen from above, in the open position,
- figure 2 is a perspective view of the watch in the coiled position,
- figures 3 and 4 show the elastic strap in its two different stable states,

- figure 5 is a cut-away top view of the watch, and
- figures 6, 7 and 8 are sections through figure 5, taken on VI-VI, VII-VII and VIII-VIII, respectively.

The figures show an electronic wristwatch 10 with a one-piece elastic strap, comprising:

- an elastic strip 12 possessing two stable states, in one of which it is straight and in the other coiled;
- a flexible printed circuit 14 fixed to the strip 12 and supporting a flexible liquid-crystal display 16 for indicating the current time, a quartz oscillator 18, an integrated circuit 20, a rechargeable battery 22, a thermoelectric generator 24 and two buttons 26 for setting the time, these various components being connected to each other, in a known manner, by conducting tracks (not shown) deposited on the printed circuit 14.

The elastic strip 12 is made of stainless steel. It typically has a thickness of between 0.10 and 0.20 mm, a width of between 2 and 4 cm and a length of between 20 and 30 cm. Advantageously, its thickness is 0.15 mm, its width 3 cm and its length 25 cm, which roughly corresponds to passing one and one-half times around the forearm. The two stable states of the strip 12 are shown in figures 3 and 4. In the first state (figure 3), it is flat and exhibits a slight transverse curvature. In the second state (figure 4) it is coiled along its length, the transverse curvature having disappeared.

Such features are obtained by rolling the strip 12 twice, first along its length and then across its width. The first rolling has the effect of stretching one of the faces more than the other, giving the strip

a tendency to coil elastically lengthwise. The second rolling of the strip gives it the transverse curvature, in such a way that the concavity is outermost when the strip is coiled up.

Consequently, when the strip 12 is flat, the transverse curvature prevents the coiling elasticity from taking effect - hence the first stable position (figure 3). When the slightest coiling impulse is given, the equilibrium is broken and the strip automatically coils itself into the second stable position (figure 4).

To clarify the terms used, notice that in the rest of the description the term "inner" will refer to anything oriented toward the inside of the ring formed by the strip 12 when coiled, and "outer" to anything oriented toward the other face of the strip.

As shown in figure 5, the flexible printed circuit 14 is in the shape of a rectangle, slightly narrower than the strip 12. It is bonded to one end 28 of the outer face of the strip 12 by means of a spot of elastic adhesive 30, also visible in figure 6, deposited at its center on the longitudinal axis of the strip. The spot 30 thus retains all its flexibility and accepts the deformations of the strip 12, without opposing the latter's elasticity.

At its point furthest from the end 28 of the strip, the circuit 14 forks into two fingers 32, leaving an open space 34 between them.

The thermoelectric generator 24 takes the form of a flexible circuit board having an outer face 36 and an inner face 38. It is advantageously of the type forming the subject-matter of application EP-02405040.3 and will therefore not be described in greater detail. It will simply be noted that its function is to convert a temperature difference between its two faces into

electrical energy. For example, a 4-cm^2 generator can produce 10 μW of power at its terminals 40.

The thermoelectric generator 24 fits in the space 34 defined between the fingers 32 of the printed circuit 14. Its inner face 38 is bonded directly to the strip 12 by a layer of elastic heat-conducting adhesive 42, visible in figure 7. The terminals 40 are connected to the conducting tracks of the printed circuit by wires 44.

The flexible liquid-crystal display 16 is bonded to the outer face of the printed circuit 14. It consists of two bands 46 and 48, one for showing the hour and the other the minutes. Band 46 has twelve boxes aligned in a column which display the series of numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Band 48 also has twelve boxes aligned in a column, which display the series of number 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55.

The quartz oscillator 18, the integrated circuit 20, the rechargeable battery 22 and the buttons 26 are rigid elements which cannot therefore adapt to the deformations of the strip 12.

In order to interfere as little as possible with the elasticity of the system, the oscillator 18, the integrated circuit 20 and the rechargeable battery 22 are separated from the strip 12 by positioning them at the edge of the printed circuit 14, that is to say as far as possible from the spot of adhesive 30 which provides the flexible connection between the circuit 14 and the strip 12. In addition, the oscillator 18, which is an elongated component, is oriented in the direction of the width of the strip. Lastly, the printed circuit 14 is cut to fit around these components, except where the conducting tracks connect these to the other components.

The two control buttons 26, meanwhile, are located on the axis of the strip 12, along the spot of adhesive 30. It is thus possible to apply the necessary pressure to them to activate them.

According to the invention, in order to make the watch 10 watertight and protected against external attacks, the complete assembly described above is enclosed in a flexible plastic sheath 50, visible in figures 5 and 8 in particular: by its color and/or its decoration, this sheath gives the watch its visual appeal, particularly by concealing the printed circuit 14.

As figures 1 and 2 show, the sheath 50 naturally has a transparent window 52 over the liquid-crystal display 16 and over the buttons 26 for setting the time.

The sheath 50 also has a safety function in that it covers the edges of the strip 12, which, being thin, can be sharp.

It may be advantageous for the sheath 50 not to cover the inner face of the strip 12 over the thermoelectric generator 22, in order not to interfere with the establishing of the temperature gradient between its two faces 38 and 40.

To explain the use and operation of the wristwatch according to the invention, reference will now be made more especially to figures 1 and 2.

In figure 1, the wristwatch 10 is laid flat, its elastic strip being in the rest or open position. When a user wishes to pass it around his wrist, he simply grasps it by the end 28, the outer face uppermost, and whips it around his wrist so that it coils automatically around the wrist. The elasticity of the strip 12 is then sufficient for the watch 10 to be held

securely in place.

When the watch 10 is thus positioned, the inner face of the elastic strip 12, and more particularly that part of it which is immediately adjacent to the thermoelectric generator 12, is in contact with the skin, while the outer face of the watch is in the open air, thus setting up an average difference of temperature of several degrees between the faces 38 and 40 of the generator 24. The latter can now supply sufficient electrical power to charge the rechargeable battery 22 which powers the various components of the watch 10.

When the wearer wishes to remove the watch, he simply grasps by its end 28 and pulls it so that it uncoils back into its first stable position. The watch 10 is now straight, which is convenient for storage.

The result is a wristwatch comprising a one-piece elastic strap which makes an excellent fit on the forearm of its wearer. Moreover, the fact that it has two stable positions makes the watch very easy to put on and take off.

The embodiment described above is only one particular example which does not limit the scope of the invention. Other means of display or of electrical power may, for example, be adapted to an elastic strip such as the strip 12 to create a watch which remains within the scope of the invention.